

## TEACHER MASTER

### Horseshoe Crab features

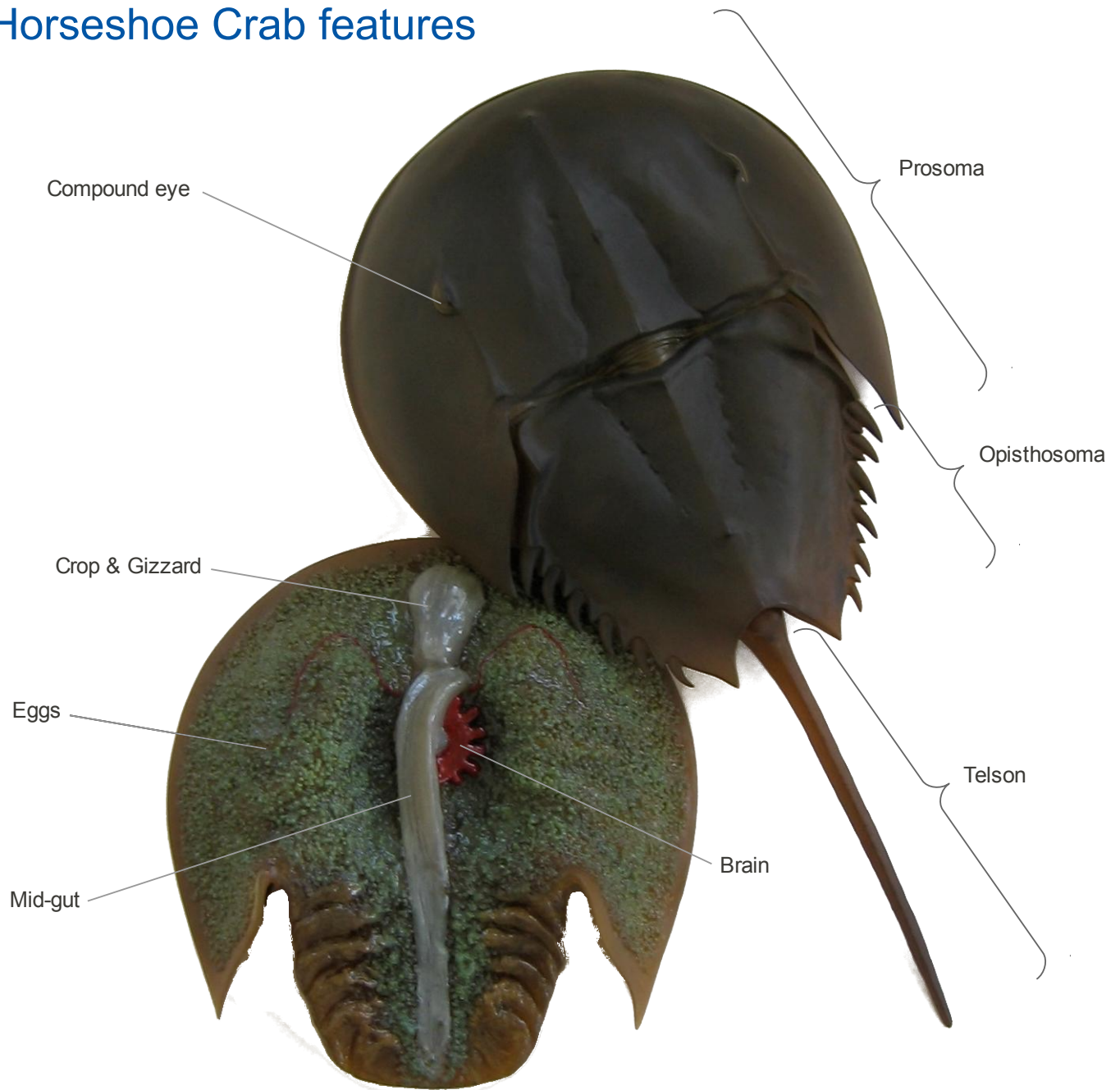


Photo: Ecological Research & Development Group Inc. [www.horseshoecrab.org](http://www.horseshoecrab.org)

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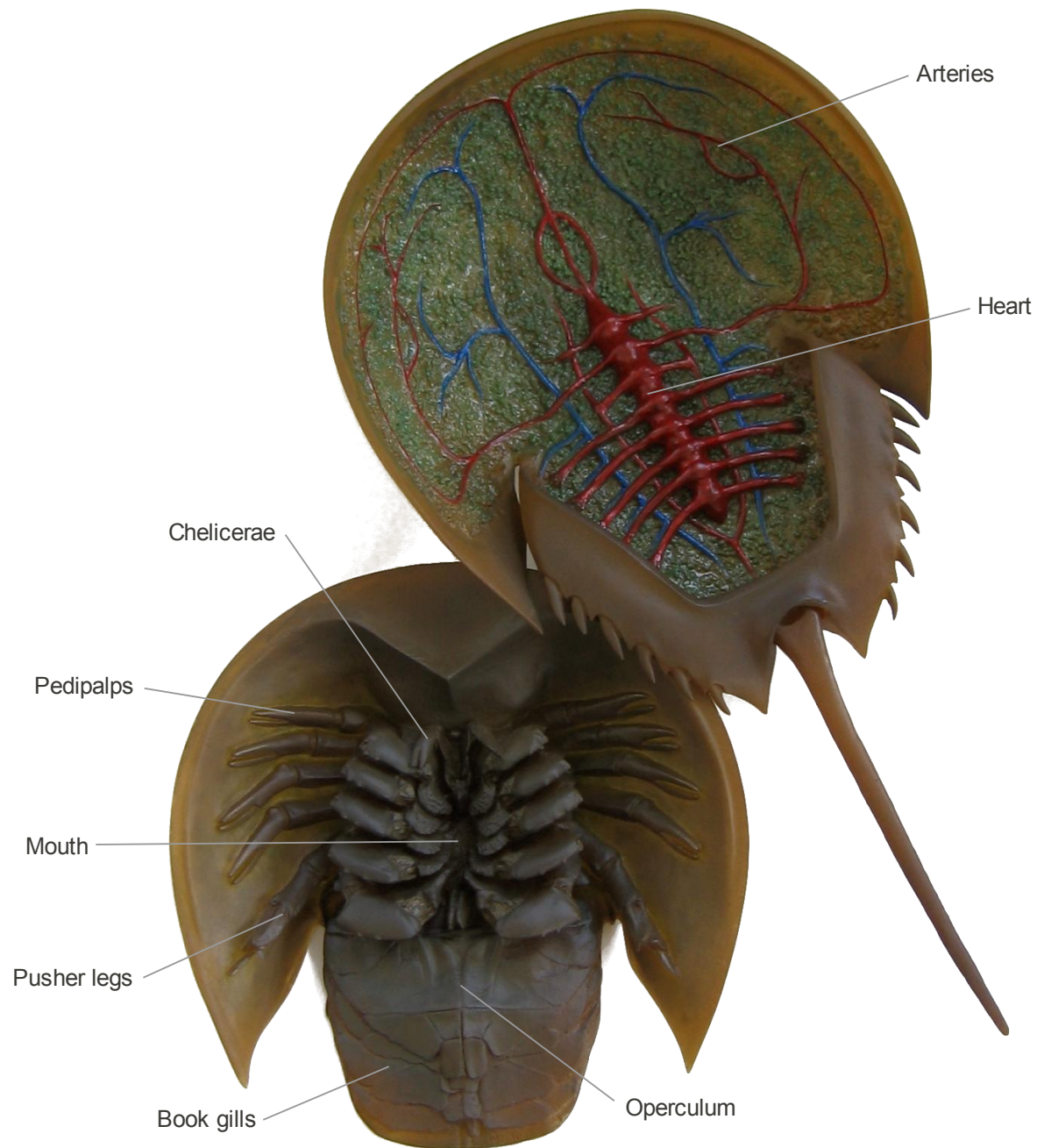


Photo: Ecological Research & Development Group Inc. [www.horseshoecrab.org](http://www.horseshoecrab.org)

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## Hooray for Horseshoe Crabs

**Horseshoe Crab**

Photo: Ecological Research & Development Group Inc.

**Blue Crab**

Photo: Mary Hollinger,  
NODC biologist, NOAA

**Spider**

Photo: Brooke Vallaster,  
NOAA, Sapelo Island NERR

When is a crab not a crab? Like other crabs, horseshoe crabs are arthropods. But so are spiders and scorpions. They all have exoskeletons, a body divided into segments, and legs with joints. But horseshoe crabs are not true crabs. They don't belong to the same class, Crustacea, as the blue crab and other crabs. True crabs have antennae, jaws, and only five pairs of legs. Horseshoe crabs don't have antennae or jaws and have six pairs of legs. Horseshoe crabs are in a class of their own: Merastomata, which means "mouth surrounded by legs."

Horseshoe crab fossils, similar in form to the ones you see in estuaries today, are found in rocks over 450 million years old. In this exercise, you are going to take a closer look at the anatomy of this ancient creature.

**Procedure**

1. Read the Background information sheet about horseshoe crab anatomy.
2. Read the clues on the four horseshoe crab diagrams (view of the top and bottom, external features and internal organs). Label the diagrams with the following features based on the clues and the information on the Background information sheet.

Eggs	Compound eye	Prosoma	Crop & gizzard
Telson	Mid-gut	Chelicerae	Brain
Mouth	Pedipalps	Arteries	Pusher legs
Heart	Operculum	Book gills	Opisthosoma

3. When you have finished labeling the horseshoe crab diagrams, answer the following questions.

**Questions**

Q1. What are the three main divisions of the horseshoe crab called?

Q2. How do horseshoe crabs move through the water? How is that different than fish, birds, and humans?

Q3. Why are horseshoe crabs considered to be arthropods? Why are they in the class Merastomata?

Q4. Where does the horseshoe crab begin its life and how does it grow?

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## Background: Horseshoe Crab Anatomy

The horseshoe crab's body is divided into three sections. The front section is called the **prosoma**. The middle section is called the **opisthosoma**. And the horseshoe crab's tail is called the **telson**. While the telson may look dangerous, the crab mainly uses it for digging and to help turn itself back over if it gets flipped over on the beach. The telson is very fragile. Horseshoe crabs should never be picked up by their tails.

Horseshoe crabs are benthic animals, meaning that they normally live along the seafloor or bottom of an estuary's bay or lagoon. Horseshoe crabs move underwater along the bottom or out of the water along the flat beach by using their five pairs of jointed legs. The fifth pair of larger **pusher legs**, found nearer the tail, is used to push the animal forward.

### Respiratory System

Like many other aquatic animals, horseshoe crabs breathe through gills. They have six pairs of gills along the bottom of the opisthosoma. These are called **book gills** because they look like pages in a book. The first pair of book gills is called the **operculum**, which helps protect the other gills and covers the opening of the pore through which the crab releases either eggs or sperm.

### Circulatory System

Horseshoe crabs have a long, tube-like **heart** that runs the length of their body (not the tail). It beats about 32 times per minute, pumping the horseshoe crab's blue blood through **arteries** and out into the rest of the crab's body.

### Digestive System

Horseshoe crabs eat small bivalves, mollusks, fish, worms, and algae. The horseshoe crab's legs are covered with bristles that grind up the food as the crab walks, eventually pushing it toward the crab's **mouth**, which is located at the point where all the legs meet. Two of those legs, called **chelicerae**, are not used for movement at all but rather for pushing food into the horseshoe crab's mouth. Food that enters the mouth is first ground up in the **crop and gizzard** before passing into the **mid-gut**, which is where the food is finally digested.

### Nervous System

The horseshoe crab's **brain** rests in the middle of the prosoma. Nerves run from the brain to the rest of the body, including to the horseshoe crab's many eyes. The horseshoe crab has two **compound eyes** on the top of the prosoma. These eyes have many lenses, making them similar to the eyes of a housefly. There are five other eyes on the top of the horseshoe crab and two eyes near the mouth on the crab's bottom. There are also light-sensitive photoreceptors on the horseshoe crab's tail.

### Life Cycle

Horseshoe crabs live in the water, but come up onto the sandy beach to reproduce. The male horseshoe crab is usually about one-third the size of the female. The male has two "boxing glove" like claws on its first set of walking legs. These specialized legs are called **pedipalps** and allow the male to hold onto the female during spawning. The female horseshoe crab is said to be larger than the male in order to hold a vast number of **eggs** within her body. Females lay between 80,000 and 100,000 eggs in the sand during one spawning season. The eggs are about 1.5 mm (1/16 inch) in diameter and greenish tan in color. Fertilization of the eggs occurs outside of the body while the female is burying the eggs on the beach.

Horseshoe crabs begin their lives as eggs buried in the sand on a beach. Many of the horseshoe crab eggs get uncovered and eaten by birds. Those that aren't eaten are left to incubate in the sand. In about four weeks, baby horseshoe crabs emerge from the eggs. Horseshoe crabs are like other animals with exoskeletons. As it grows, the

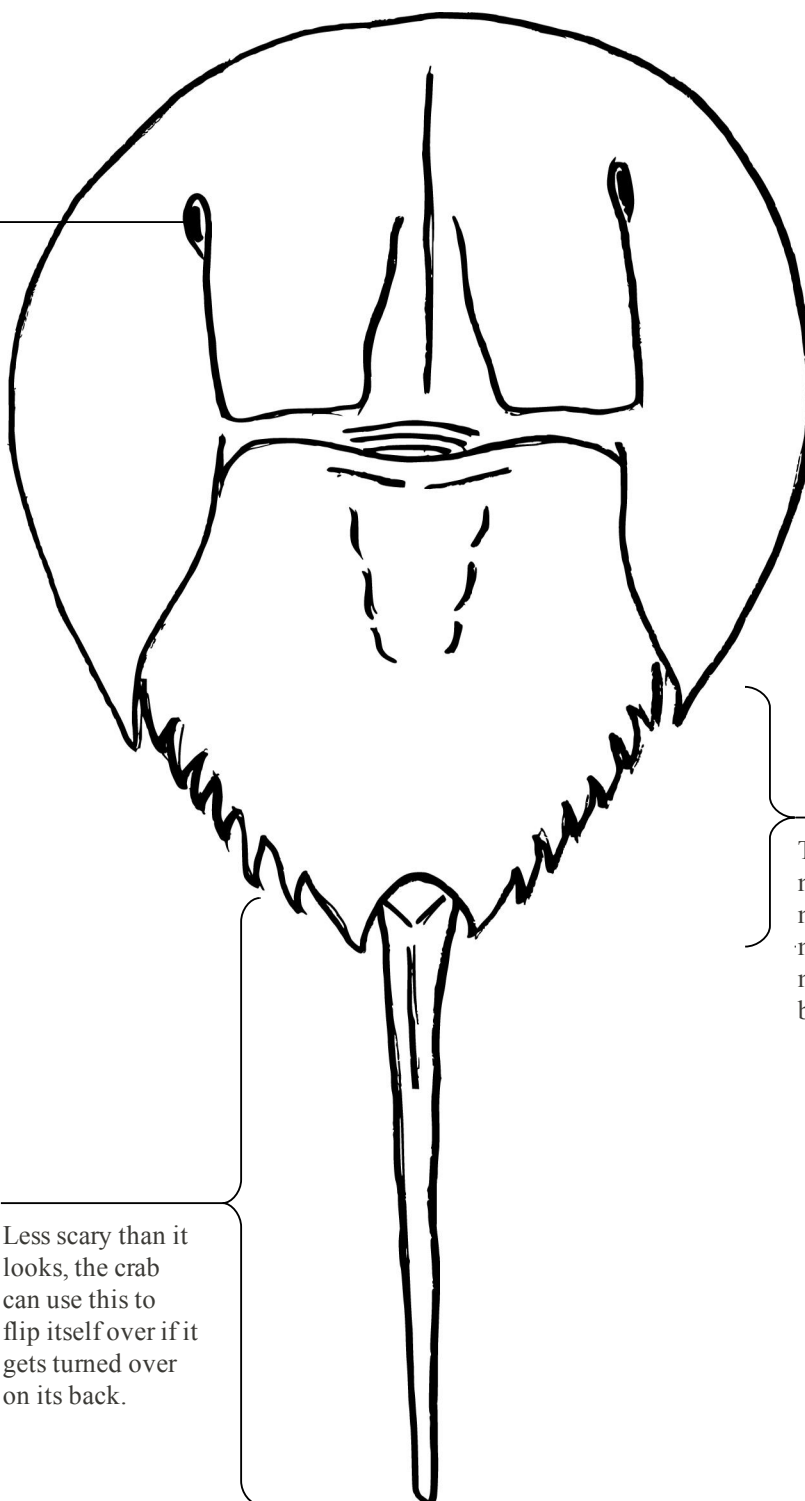
horseshoe crab outgrows its shell, called a carapace. The crab molts, leaving its old shell behind and growing a new, larger shell. A horseshoe crab will molt 16 to 18 times over a period of about 10 years until it reaches adulthood. Horseshoe crabs can live to be about 20 years old if they do not get eaten by predators, get stranded on the beach, become injured, or get a disease.



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## Horseshoe Crab: External features (top view)

These might be the most obvious, but the horseshoe crab has 5 additional eye on its top, 2 on its bottom, plus light sensors along the top and bottom of its tail.



The "head" section of the horseshoe crab contains much of the crab's nervous and digestive system, plus the muscles to move its legs.

The horseshoe crab's middle section mostly contains the muscles needed to move its tail and to breathe.

Less scary than it looks, the crab can use this to flip itself over if it gets turned over on its back.

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### Horseshoe Crab: External features (bottom view)

This first pair of walking legs is also used by the male during spawning.

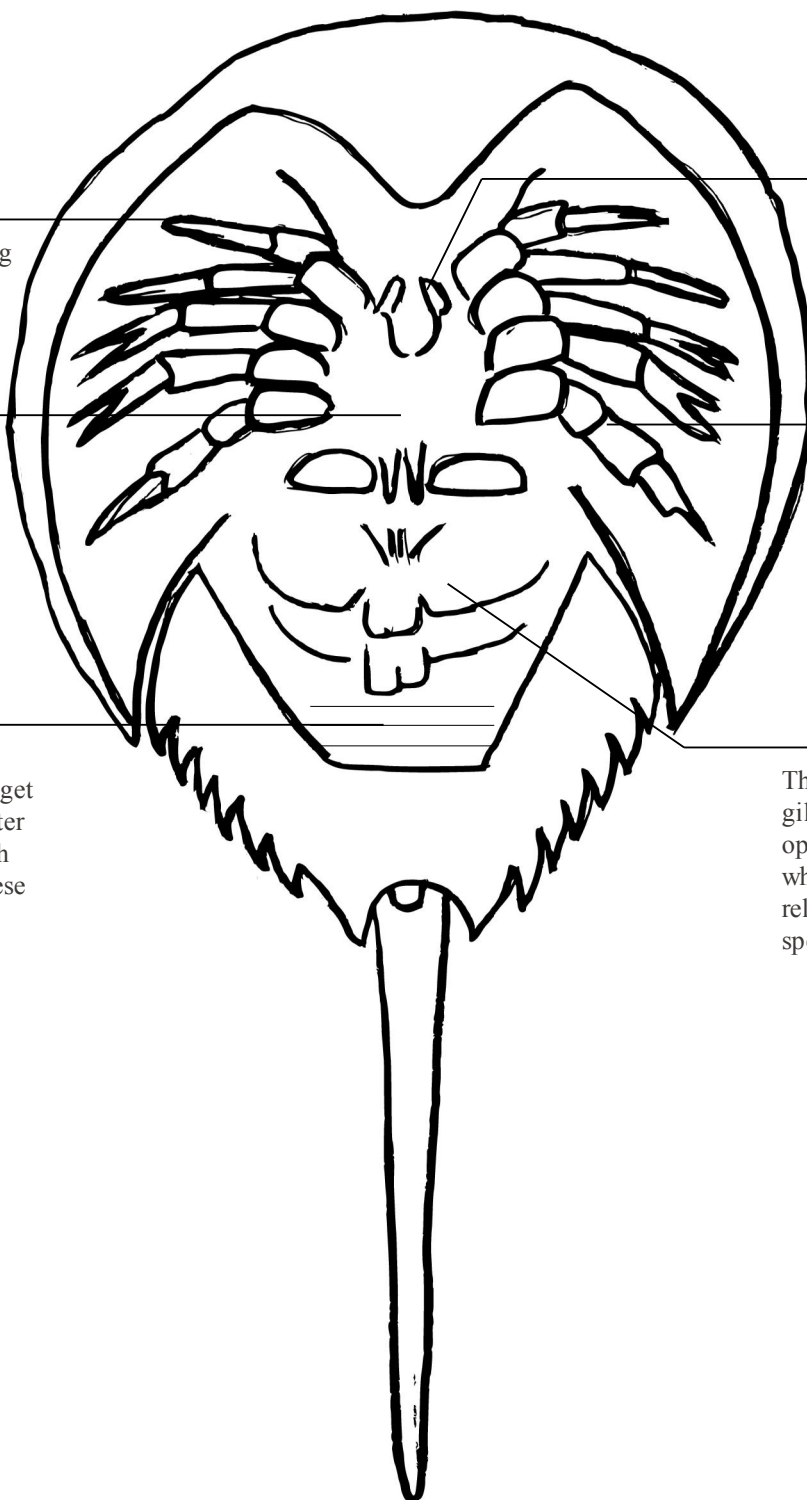
The start of the crab's digestive tract is located where all the legs come together.

Crabs have to breathe and they get oxygen when water circulates through the "pages" of these features.

More like arms than legs, these are useful for getting food into the crab's mouth.

When it comes time to move, the last pair of legs gets the crab scuttling across the sand.

This covers the other gills and the opening through which the crab releases eggs or sperm.

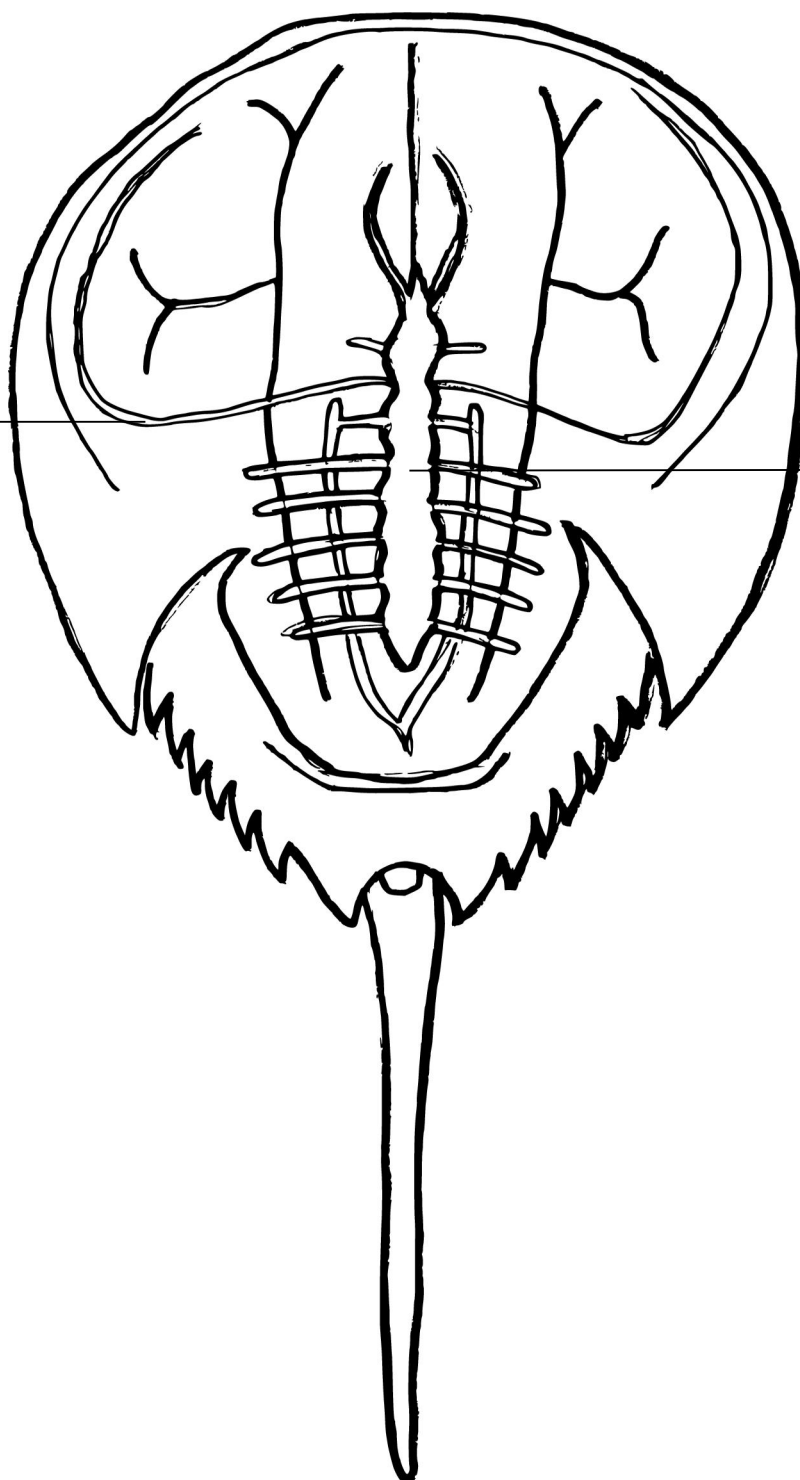




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## Horseshoe Crab: Internal features (top view)

The horseshoe crab's blood leaves through these tubes, eventually going into the book gills to get oxygen before returning to the heart.



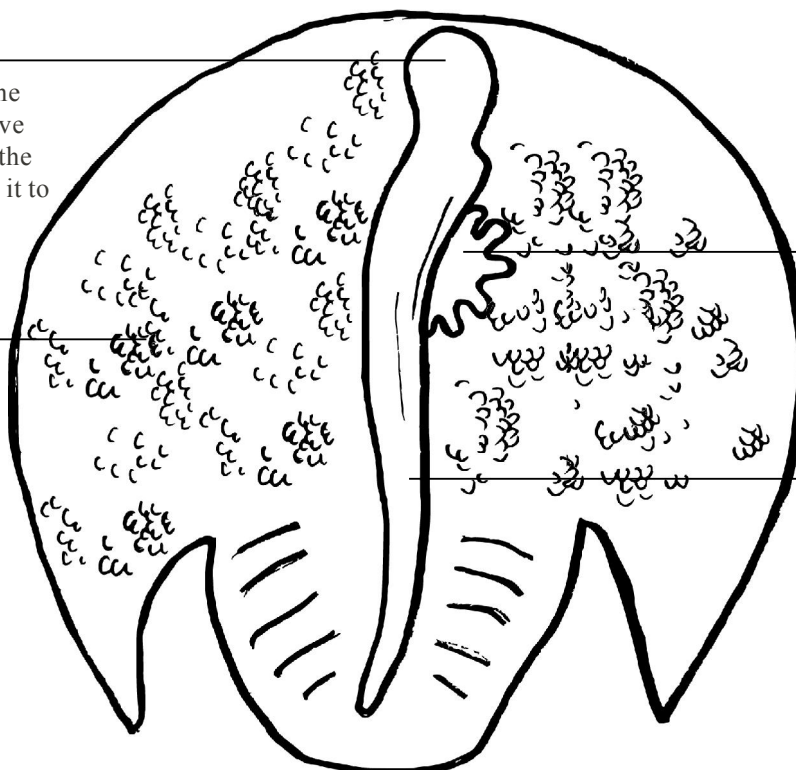
This circulatory organ extends almost the entire length of the horseshoe crab's body and beat 32 times per minute.

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## Horseshoe Crab: Internal features (bottom view)

Near the beginning of the horseshoe crab's digestive tract, these parts gather the food together and grind it to a pulp.

An adult female horseshoe crab can lay over 80,000 of these each year.



Like other animals, this organ is the center of the horseshoe crab's nervous system.

Pulverized food passes into this part of the horseshoe crab to be digested.